

ANDREA SCHUMACHER

Tropical Cyclone Researcher – Hazards, Impacts, and Risk Communication

CONTACT

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Pronouns: she/her

PERSONAL PROFILE

I am an experienced applied atmospheric science researcher who has been developing forecast guidance products for over 15 years. Several of the products I've co-developed are used regularly by operational forecasters around the world. I have a solid record of obtaining competitive funding, having served as PI on over a dozen grants. I've led numerous research teams and have ample experience managing budgets, staffing, and accounting for performance.

I believe in needs-based research and development, which revolves around listening to forecasters, understanding their needs, workflow, and operational constraints, and working closely and iteratively with partners from start to finish.

I thrive working with interdisciplinary teams to solve real-world problems! I have developed many strong collaborative relationships with scientists in other disciplines. My most recent collaborations include working on hurricane health impacts, risk communication, and assessing forecaster perceptions of AI.

EDUCATION

MASTER OF SCIENCE IN ATMOSPHERIC SCIENCES 2005
Colorado State University
Fort Collins, CO

- Specializations: Tropical cyclone dynamics and genesis
- Thesis: A Vortical Hot Tower Approach to Tropical Cyclogenesis

BACHELOR OF ARTS IN MATHEMATICS / CHEMISTRY 2000
New College of Florida
Sarasota, FL

- Specializations: Graph theory, abstract algebra, and organic chemistry
- Thesis: Optimal Transitional Labelings of Graphs: A Polarization Approach

PROFESSIONAL EXPERIENCE

2021-present	RESEARCH ASSOCIATE IV, CIRA/Colorado State University
2020-present	RESEARCHER, National Center for Atmospheric Research, Microscale and Mesoscale Meteorology Laboratory
2020-2021	GOES-R SATELLITE TRAINING LIAISON, CIRA/Colorado State University
2015-2019	GOES-R SATELLITE LIAISON TO THE NATIONAL HURRICANE CENTER, CIRA/Colorado State University
2012-2021	RESEARCH ASSOCIATE III, CIRA/Colorado State University
2006-2012	RESEARCH ASSOCIATE II, CIRA/Colorado State University
2001-2004	GRADUATE RESEARCH ASSISTANT, Colorado State University
2002-2004	GRADUATE TEACHING ASSISTANT, Atmospheric Dynamics I, Colorado State University
1999	SUMMER RESEARCH INTERN, Center for Nonlinear Analysis REU, Carnegie Mellon University
1998-1999	UNDERGRADUATE TEACHING ASSISTANT, Calculus I & II and Calculus with Theory, New College of Florida

FORECAST PRODUCTS DEVELOPED/IMPROVED

- TROPICAL CYCLONE FORMATION PROBABILITY (TCFP) PRODUCT (primary developer) [<https://www.ssd.noaa.gov/PS/TROP/TCFP/index.html>]
- TROPICAL CYCLONE GENESIS INDEX (TCGI) (co-developer) [https://rammb.cira.colostate.edu/projects/tc_genesis/index_2020.asp]
- NHC WIND SPEED PROBABILITY (WSP) PRODUCT (updates and improvements) [<https://www.nhc.noaa.gov>]
- STORMWINDMODEL (co-developer) [<https://cran.r-project.org/web/packages/stormwindmodel/index.html>]
- HURRICANEEXPOSURE (co-developer) [<https://cran.r-project.org/web/packages/hurricaneexposure/index.html>]

FUNDED RESEARCH GRANTS AND CONTRACTS

- 2021-2023 “Unification and Improvements to Guidance for National Weather Service Tropical Cyclone Wind and Storm Surge Hazard Products.” PI: **A. Schumacher**, co-PI: K. Musgrave. Funded by NOAA-OAR-Joint Technology Transfer Initiative (JTII) [\$353K]
- 2018-2020 “Using dynamically-based probabilistic forecast systems to improve the National Hurricane Center wind speed probability products.” PI: **A. Schumacher**, co-PI K. Musgrave. Funded by NOAA Research to Operations (R2O) Hurricane Forecast Improvement Project (HFIP) [\$200K]
- 2016-2017 “Tropical Cyclone Forecast Aid Improvements.” PIs: **A. Schumacher**, K. Musgrave, J. Knaff, and C. Sampson. Funded by DOD/Joint Typhoon Warning Center (Contract). [\$315]
- 2015-2017 “Improvements to Operational Statistical Tropical Cyclone Intensity Forecast Models.” PIs: G. Chirokova and **A. Schumacher**, NOAA Partner: J. Knaff. Funded by NOAA Joint Hurricane Testbed (JHT). [\$167K]
- 2015-2017 “Improvement to the Tropical Cyclone Genesis Index (TCGI).” PI: J. Dunion, co-PIs: J. Kaplan and **A. Schumacher**. Funded by NOAA Joint Hurricane Testbed (JHT). [\$84K]
- 2014-2015 “CIRA Support to Monte Carlo Model-based Wind Arrival and Departure Estimates.” PI: A. Schumacher, NOAA Partner: M. DeMaria. Funded by Hurricane Sandy Supplemental Funding for NOAA [\$93K]
- 2013-2015 “Upgrades to the Operational Monte Carlo Wind Speed Probability Program.” PI: **A. Schumacher**, NOAA Partner: M. DeMaria. Funded by NOAA Joint Hurricane Testbed (JHT). [\$86K]
- 2013-2015 “Guidance on Intensity Guidance.” PI: D. Nolan, co-PI: **A. Schumacher**, NOAA Partner: M. DeMaria. Funded by NOAA Joint Hurricane Testbed (JHT). [\$152K]
- 2012-2013 “New Statistical-Dynamical Intensity Forecast Models for the Indian Ocean and Southern Hemisphere.” PI: **A. Schumacher**, NOAA Partners: M. DeMaria and J. Knaff. Funded by DOD/Joint Typhoon Warning Center [\$96K]
- 2012-2013 “CIRA Support for Transition of Tropical Cyclone Forecast Products.” PI: **A. Schumacher**, NOAA Partners: M. DeMaria and J. Knaff. Funded by The NESDIS Center for Satellite Applications and Research and GOES-Product Systems Development and Implementation (PSDI) program. [\$90K]
- 2011-2013 “Development of a Probabilistic Tropical Cyclone Prediction Scheme.” PI: J. Dunion, co-PIs: J. Kaplan, **A. Schumacher**, and J. Cossuth [\$190K]

PUBLICATIONS – REFEREED

1. Anderson, G. B., **A. Schumacher**, and J. M. Done: Exposure assessment for tropical cyclone epidemiology. Current *Environmental Health Reports*, In Review.
2. Anderson, G. B., **A. Schumacher**, J. M. Done, and J. Hurrell: Projecting the impacts of a changing climate: Tropical cyclones & flooding. Current *Environmental Health Reports*, In Review.
3. Nethery, R. C., N. Katz-Christy, M. Kioumourtzoglou, R. M. Parks, **A. Schumacher**, and G. B. Anderson, 2021: Integrated causal-predictive machine learning models for tropical cyclone epidemiology, *Biostatistics*, <https://doi.org/10.1093/biostatistics/kxab047>.
4. Anderson G. B., J. Ferreri, M. Al-Hamdan, W. Crosson, **A. Schumacher**, S. Guikema, S. Quiring, D. Eddebuetel, M. Yan, and R. D. Peng, 2020: Assessing United States county-level exposure for research on tropical cyclones and human health. *Environmental Health Perspectives*. 128(10), <https://doi.org/10.1289/EHP6976>.

5. Yan, M., A. Wilson, S. Magzamen, F. Dominici, Y. Yang, M. Al-Hamdan, W. Crosson, **A. Schumacher**, S. Guikema, R. Peng, and G. B. Anderson, 2020: Tropical cyclone exposures and risks of emergency Medicare hospital admission for cardiorespiratory diseases in 175 United States counties, 1999–2010. *Epidemiology*. 32(3), 315-326, <https://doi.org/10.1097/EDE.0000000000001337>.
6. Bhatia, K. T., D. S. Nolan, M. DeMaria, and **A. B. Schumacher**, 2017: Improving Tropical Cyclone Intensity Forecasts with PRIME, *Wea. Forecasting*, 32(4), 1353-1377.
7. Sampson, C. R., J. A. Hansen, P. A. Wittmann, J. A. Knaff, and **A. B. Schumacher**, 2016: Wave Probabilities Consistent with Official Tropical Cyclone Forecasts. *Wea. Forecasting*, 31, 2035-2045.
8. Quiring, S. M., **A. B. Schumacher**, and S. Guikema, 2014: Incorporating Hurricane Forecast Uncertainty into a Decision-Support Application for Power Outage Modeling. *Bull. Amer. Meteor. Soc.*, 95(1), 47-58.
9. DeMaria, M., J. A. Knaff, M. J., Brennan, D. B. Brown, R. D. Knabb, R. T. DeMaria, **A. B. Schumacher**, C. A. Lauer, D. P. Roberts, C. R. Sampson, P. Santos, D. Sharp, and K. A. Winters, 2013: Improvements to the Operational Tropical Cyclone Wind Speed Probability Model. *Wea. Forecasting*, 28, 586-602.
10. Sampson, C. R., **A. B. Schumacher**, J. A. Knaff, M. DeMaria, E. M. Fukada, C. A. Sisko, D. P. Roberts, K. A. Winters and H. M. Wilson, 2012: Objective Guidance for Use in Setting Tropical Cyclone Conditions of Readiness. *Wea. Forecasting*, 27, 1052–1060.
11. Quiring, S., **A. Schumacher**, C. Labosier, and L. Zhu, 2011: Variations in mean annual tropical cyclone size in the Atlantic, *J. Geophys. Res.*, 116, D09114, doi:10.1029/2010JD015011.
12. Schumacher, R. S., D. T. Lindsey, **A. B. Schumacher**, J. Braun, S. D. Miller, J. L. Demuth, 2010: Multidisciplinary Analysis of an Unusual Tornado: Meteorology, Climatology, and the Communication and Interpretation of Warnings. *Wea. Forecasting*, 25, 1412–1429.
13. Rappaport, E. N., J. L. Franklin, **A. B. Schumacher**, M. DeMaria, L. K. Shay, and E. J. Gibney, 2010: Tropical cyclone intensity change before U.S. Gulf coast land fall. *Wea. Forecasting*, 25, 1380-1396.
14. Sherman-Morris, K., **A. Schumacher**, S. Drobot and K. McNeal, 2010: Hurricane Preparedness and Response among Pet Care Providers along the Gulf Coast: An Investigation of Hurricanes Gustav and Ike. *International Journal of Mass Emergencies and Disasters*, 28 (3).
15. **Schumacher, A. B.**, M. DeMaria, and J. A. Knaff, 2009: Objective Estimation of the 24-h Probability of Tropical Cyclone Formation. *Wea. Forecasting*, 24, 456–471.
16. Knaff, J. A., T. A. Cram, **A. B. Schumacher**, J. P. Kossin and M. DeMaria, 2008: Objective identification of annular hurricanes. *Wea. Forecasting*, 23, 17-28.
17. Montgomery, M. T., M. E. Nicholls, T. A. Cram and **A. B. Saunders**. 2006: A Vortical Hot Tower Route to Tropical Cyclogenesis. *J. Atmos. Sci.*, 63, 355–386.

PUBLICATIONS - NON-REFEREED (INCLUDES DATASETS AND SOFTWARE PUBLISHED)

- Anderson G. B., **A. Schumacher**, S. Guikema, S. Quiring, J. Ferreri, A. Staid, M. Guo, L. Ming, and L. Zhu, 2020: `stormwindmodel`: Model tropical cyclone wind speeds. Version 0.1.4 [Software]. Available from: <https://cran.r-project.org/web/packages/stormwindmodel/index.html>.
- Anderson G. B., M. Yan, J. Ferreri, W. Crosson, M. Al-Hamdan, **A. Schumacher**, and D. Eddelbuettel, 2020: `hurricaneexposure`: Explore and Map County-Level Hurricane Exposure in the United States. Version 0.1.1 [Software]. Available from: <https://cran.r-project.org/web/packages/hurricaneexposure/index.html>.
- Anderson G. B., **A. Schumacher**, W. Crosson, M. Al-Hamdan, M. Yan, J. Ferreri, Z. Chen, S. Quiring, and S. Guikema, 2020: `hurricaneexposedata`: Data Characterizing Exposure to Hurricanes in United States Counties. Version 0.1.0 [Software]. Available from: <https://github.com/geanders/hurricaneexposedata>.

- Schumacher, A. B.,** K. Sherman-Morris, K. McNeal, and S. Drobot, 2008: Pet Care Professionals' Preparedness for, Response to, and Utilization of Resources during Hurricane Gustav. *Quick Response Report #QR210*, https://hazards.colorado.edu/uploads/quick_report/morris_2008.pdf.
- Schumacher, A. B.,** 2008: After WAS*IS Ecstasy, The Laundry: One Atmospheric Scientist's Experience. *Weather and Society Watch*, Vol. 2.2, January 2008, pp. 7, http://www.sip.ucar.edu/news/pdf/WSW_January_2008.pdf.

PRESENTATIONS – INVITED

- Schumacher, A. B., 2021: Using hurricane data for health impacts research. International Society for Environmental Epidemiologists – North American Chapter (ISEE-NAC) Workshop on Climate Change, Hurricanes, and Health. Virtual (<https://www.youtube.com/watch?v=Lr8DcDfi7XI>), 14 April 2021.
- Schumacher, A. B., 2017: GOES-16 Capabilities & the 2017 Hurricane Season. *Denver/Boulder Chapter of the American Meteorological Society Seminar*, NCAR Mesa Lab, Boulder, CO, 7 December 2017.
- Schumacher, A. B., 2017 (Recorded): GOES-16 Applications for Hurricane Forecasting. *WMO RA-IV Hurricane Committee - 39 Meeting*, San Jose, Costa Rica, 23 March 2017.
- Schumacher, A. B. and E. Dagg, 2015: An examination of situation-specific hurricane forecast uncertainty statements in NHC Tropical Cyclone Discussions. *National Hurricane Center Science Seminar*, Miami, FL, 12 November 2015.
- Schumacher, A. B. and M. DeMaria, 2015: Applications of GOES-R and JPSS at the National Hurricane Center, *GOES-R Science Seminar*, 31 March 2015 (remote).
- Schumacher, A. B., 2008: Hurricane Research in the Rockies: Recent Research to Operations Activities at CIRA. *Weekly Hurricane Seminar Series*, National Hurricane Center, Miami, FL, October 2008.

CONFERENCE PAPERS AND PRESENTATIONS (LAST 5 YEARS)

- Schumacher, A.B. and coauthors, 2022: Longitudinal Analysis of Hurricanes Laura and Marco. Part I: Public Perceptions of Exposure to Hurricane Forecasts and Warnings, *102nd AMS Annual Meeting*, virtual, 26 January 2022.
- Schumacher, A. B., J. LaDue, and K. Scharfenberg, 2019: Identifying Best Practices for Integrating GOES Imagery and Products into Short Term Forecasting and Warning Decision Making. *AMS Joint Satellite Conference*, 29 September – 4 October 2019.
- Schumacher, A. B., 2018: New Methods for Incorporating Situation-specific Track Uncertainty into the Monte Carlo Wind Speed Probability Model. *33rd Conference on Hurricanes and Tropical Meteorology*, Ponte Vedra, FL, 16-20 April 2018.
- Schumacher, A. B., 2018: Development and Communication of Next-Generation Satellite Information for Forecasting Extreme Weather—Part I (Panel Member), *98th AMS Annual Meeting*, Austin, TX, 7-12 January 2018.

TEACHING AND EDUCATIONAL OUTREACH

- Schumacher, A. B. K. Musgrave, and C. Slocum, 2020: AMS Short Course: From GOES-R and JPSS Satellite Data to Disaster Response: Every Decision Counts – Tropical Cyclones, *100th AMS Annual Meeting*, Boston, MA, 12 January 2020.

Schumacher, A. B. and M. Folmer, 2018: GOES-R Series Workshop: Tropical Applications for Users. *33rd Conference on Hurricanes and Tropical Meteorology*, Ponte Vedra, FL, 16-20 April 2018.

Schumacher, A. B. and M. Folmer, 2018: AMS Short Course: GOES-R Series: Products and User Applications – Tropical Cyclones, *98th AMS Annual Meeting*, Austin, TX, 7 January 2018.

Schumacher, A. B. and M. Folmer, 2017: NHC GOES-R Supplemental Training Workshop. National Hurricane Center, Miami, FL, 16 February 2017.

Schumacher, A. B., 2017: GOES-16 Tropical Applications. *GOES-R Series Faculty Virtual Course: Tropical Cyclones*, 6 September 2017, Online presentation (https://www.meted.ucar.edu/training_module.php?id=1311#.WnCuu6inF9N)

Schumacher, A. B. and G. Chirokova, 2017: AMS Short Course: JPSS Products and User Applications – Tropical Cyclones, *97th AMS Annual Meeting*, Seattle, WA, 22 January 2017.

Schumacher, A. B. and M. DeMaria, 2011: Tropical Cyclone Applications of Satellite Data, *COMET Faculty Course*, CIRA, Fort Collins, CO, 10 August 2011.

AWARDS AND HONORS

- Outstanding Achievement Award - Meteorology, National Hurricane Conference (2019)
- Leadership Award, Louisiana Emergency Preparedness Association (2019)
- Governor's Award for High Impact Research (Team Member), CO-LABS (2012)
- Research Initiative Award, Cooperative Institute for Research in the Atmosphere (2012)
- Research Initiative Award, Cooperative Institute for Research in the Atmosphere (2008)
- AMS Industry/Government Graduate Fellowship, American Meteorological Society (2001-2002)
- 3F Fellowship, Colorado State University Dept. of Atmospheric Science (2001-2002)

PROFESSIONAL DEVELOPMENT

- Visiting Scientist Program, National Hurricane Center, Miami, FL, 6-10 October 2008.
- Advanced Weather and Society Integrated Studies (WAS*IS) Workshop in conjunction with the NOAA Hazardous Weather Testbed's Experimental Warning Program (EWP) in Norman, OK, 15-17 September 2008.
- Weather and Society Integrated Studies (WAS*IS) Workshop at the National Center for Research in the Atmosphere (NCAR) in Boulder, CO, 12-20 July 2007.

CERTIFICATIONS

- UCAR Researchers Involved in Human Subjects Research, CITI Program, expires 8/2023

PROFESSIONAL SERVICE

- Rapporteur, Forecasting Wind Hazards and Impacts, 10th International Workshop on Tropical Cyclones (2022)
- SOARS Mentor for Ebone Smith, NCAR (2021-present)
- REU Mentor for Gillian Felton, CSU Dept of Atmospheric Sciences (summer 2021)
- WMO Tropical Cyclone Probabilistic Forecast Product Workshop Writing Team (2021-present)

- American Meteorological Society Local Chapter Affairs Executive Committee (2016-2019)
- Fort Collins Atmospheric Scientists (FORTCAST, AMS Local Chapter) Executive Board (2015-2016)
- Search Committee Chair, Colorado State University (2006-present)
- AMS Hurricanes and Tropical Meteorology Conference Organizing Committee (2015-2016)
- Graduate Student Representative, Dept. of Atmospheric Sciences, Colorado State University (2002-2003)
- Reviewer for Journal of Applied Meteorology and Climatology, Remote Sensing of the Environment, Weather and Forecasting, Monthly Weather Review, IEEE Transactions on Geoscience and Remote Sensing, Atmospheric Research, and JGR-Atmospheres

PROFESSIONAL MEMBERSHIPS

- Society for Risk Analysis (since 2020)
- American Meteorological Society (since 2001)
- Weather and Society Integrated Studies (WAS*IS) Fellow (since 2007)

COMPUTER SKILLS

- Operating Systems: Linux, Windows, Mac
- Scripting languages: Perl, Bash
- Programming: FORTRAN, R, Python, IDL
- Visualization: GrADS, R, QGIS
- Statistical Analysis: FORTRAN IMSL, R, Atlas.ti, SPSS
- Communication and Collaboration: Slack, Teams, Google Meet, Zoom